

CREATING BALANCE

# **Ensuring Sustainable Solutions for Metals and Associated Contaminants at DOD Facilities**

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# Outline

1. Introduction: Problem Description
2. Lead Stabilization Chemistry
3. Case Study # 1 – Lead Arsenate Contaminated Soil
4. Case Study # 2: Langley AFB Firing Range Treatment
5. Conclusions

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# Problem

**Many sites have with more than one contaminant**

**Need to ensure that treatment for one contaminant does not create or exacerbate a problem from the second contaminant**

**Need to understand environmental and treatment chemistry for both contaminants to ensure sustainable treatment**

**Two case studies, both involving lead stabilization, illustrate problem**

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# **Lead Stabilization Chemistry**

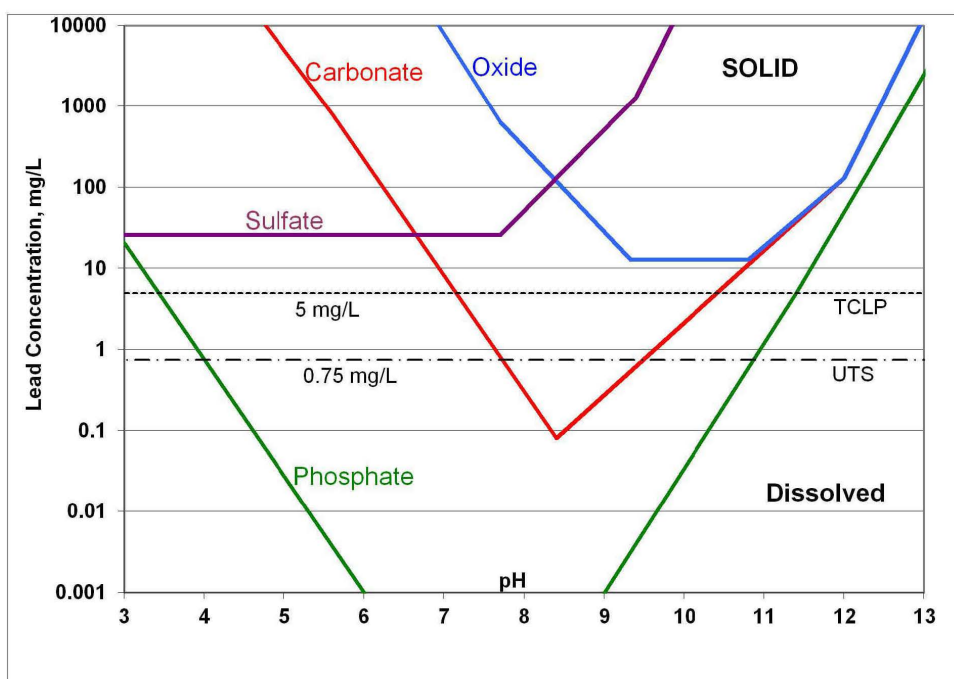
**Lead forms highly insoluble phosphate compounds, can be used to stabilize lead against leaching in both regulatory leaching tests and in natural environment**

**Solubility shown in log concentration- pH plot (Next Slide)**

**Problems come from either anions released by phosphate (e.g. arsenic) or from phosphate itself**

# Lead Stabilization Chemistry

## Solubility of Lead Species as a Function of pH



## **Case Study #1: Lead Arsenate Contaminated Soil**

**Lead arsenate widely used as pesticide prior introduction of DDT**

**One application was on apple and cherry orchards**

**Soil in Door County, Wisconsin found to contain both lead and arsenic, groundwater had elevated lead levels.**

**Source was tracked to the use of lead arsenate in the orchards**





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## **Case Study #1: Lead Arsenate Contaminated Soil**

**Some soils leached lead above Hazardous Waste criterion (5.0 mg/L) in TCLP Test.**

**No soils hazardous for arsenic.**

**Ran Treatability tests for lead stabilization – phosphate (Triple Superphosphate, or TSP) very effective**

**For some soils, phosphate caused release of arsenic to above hazardous waste criterion (5 mg/L)**

**Evaluated use of pH adjustment to control arsenic leaching (by calcium arsenate formation)**



## Case Study #1: Lead Arsenate Contaminated Soil

TCLP Test Results			
	pH	As	Pb
Soil A			
Untreated	5.1	<0.2	370
+2.5% TSP	5.1	<0.2	7.5
+5.0 % TSP	5.0	<0.2	3.6
+ 10% TSP		<0.2	0.4
Soil B			
Untreated	5.1	2.2	18.6
+ 5.0 % TSP	5.1	9.3	<0.6
+ 5.0 % TSP + 5% MgO	6.6	7.3	<0.2
+ 5.0 % TSP + 10% MgO	10.0	0.098	<0.2



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## **Case Study #1: Lead Arsenate Contaminated Soil**

**Results: Both arsenic and lead leaching can be controlled using phosphate and pH control.**

**Chemistry successfully applied at a number of small sites**



## Case Study #2: Langley AFB

- Located between NW and SW branches of the Back River (Chesapeake Bay)
- Skeet shooting range – lead shot and target debris
- Elevated lead (~250 mg/l) in soils on range and sediments in cove (~18 mg/l)
- Chemical stabilization cannot increase levels of phosphate in Back River



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## Case Study #2: Langley AFB

Remedy – Stabilization (TCLP Pb <5.0 mg/L) of range soils and sediments using phosphate-based chemical ,

Add ferric sulfate to reduce the release of phosphate in the SPLP

Sample	TCLP		SPLP		
	pH	Pb, mg/L	pH	P, mg/L	Pb, mg/L
Untreated	5.13	140	6.66	0.663	2.0
+1% TSP	5.02	2.1	6.68	42	0.05
+ 2% TSP	5.05	0.68	6.26	88	0.15
1% TSP +					
0.5% ferric sulfate			9.77	0.32	<0.013
1.0% ferric sulfate			9.68	0.67	<0.013

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## Langley AFB

- **Scope of Work**

- Installation of 2,500 lf of temporary dam structure (sheet pile + Portadam+AquaDam)
- Dewater cove (9.8 million gallons)
- Construct temporary access roads (1,200 lf) into cove
- *In-situ* stabilization of 17,000 cy of cove sediments
- *In-situ* stabilization of 26,000 cy of range soils
- Construction of 3.2 acre onsite consolidation area
- Placement of 43,000 cy of stabilized materials in consolidation area (90% Standard Proctor)
- Capping of onsite consolidation area with 18,500 tons of clay and 5,000 cy of topsoil
- Restoration of disturbed wetland areas and construction of 5 acres of new wetlands

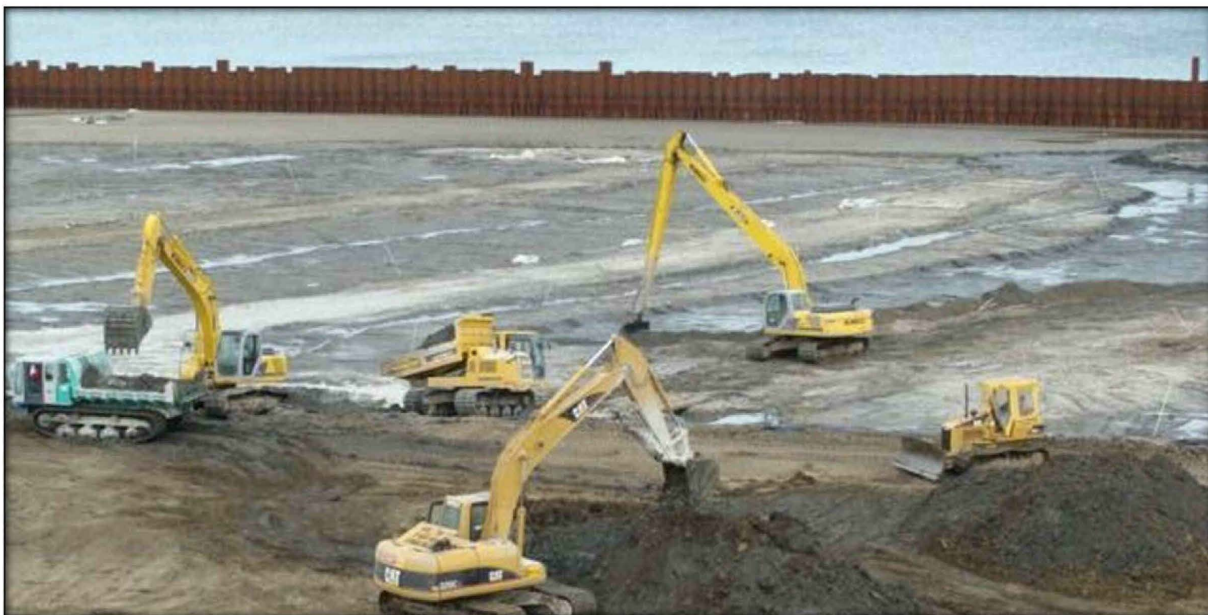
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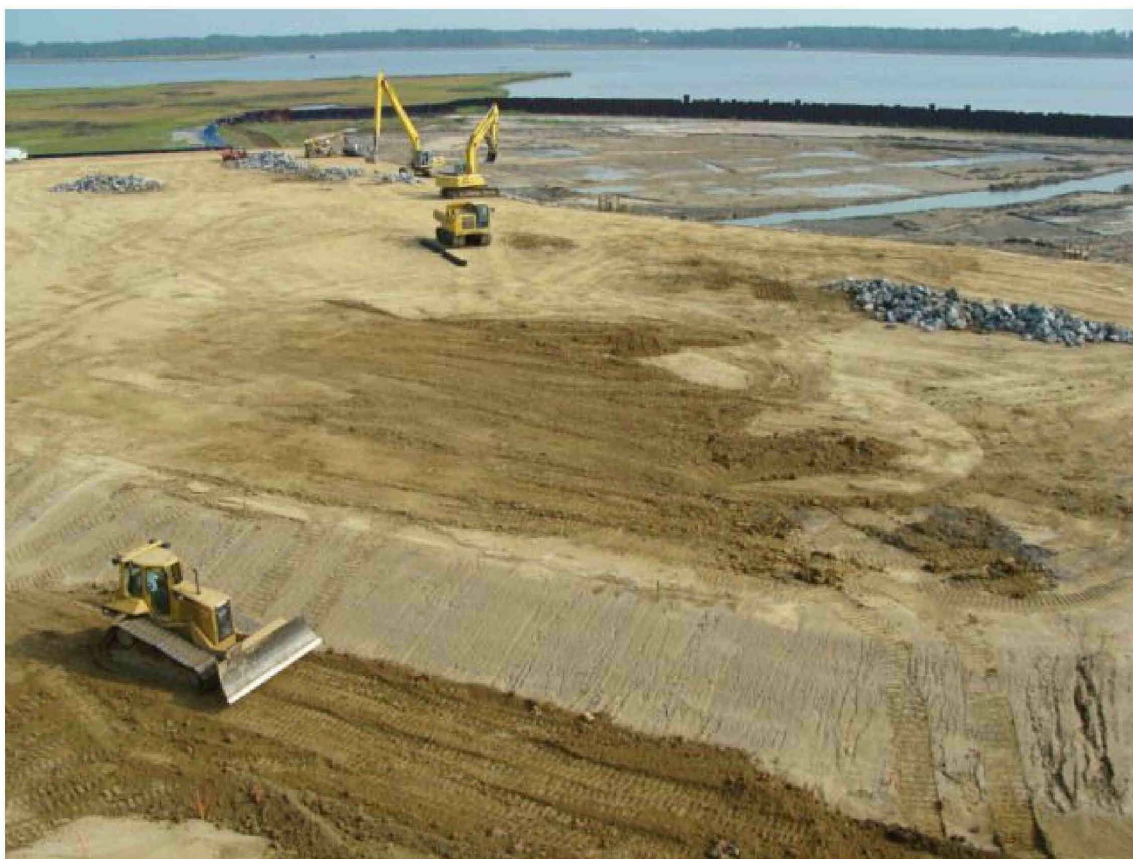
# Langley AFB – Hampton, VA





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# Langley AFB – Hampton, VA



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## Conclusions

**More than one contaminant can be treated concurrently, but need to optimize treatment for both by understanding chemistry controlling both leaching and stabilization**